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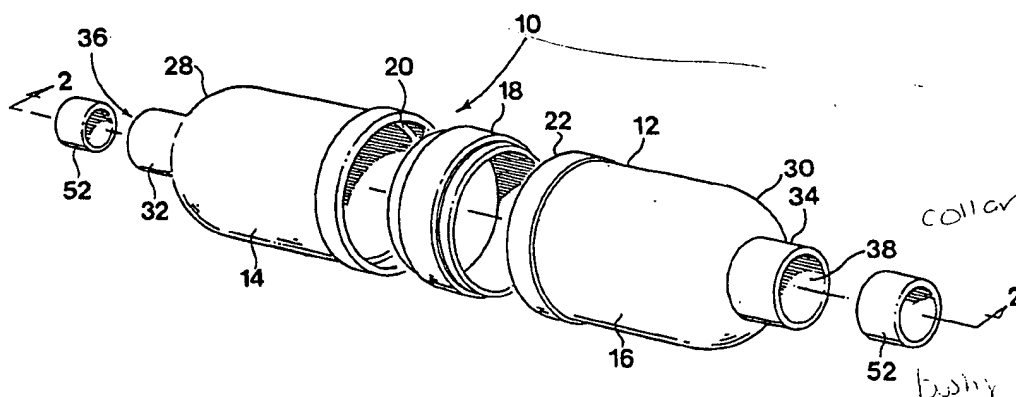
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<p>(21) International Application Number: PCT/GB98/03490 (22) International Filing Date: 20 November 1998 (20.11.98) (30) Priority Data: 97/10503 21 November 1997 (21.11.97) ZA (71) Applicant (for IS only): SKONE JAMES, Robert, Edmund [GB/GB]; Gill Jennings & Every, Broadgate House, 7 Eldon Street, London EC2M 7LH (GB). (71)(72) Applicants and Inventors: FERREIRA, Stephanus [ZA/ZA]; 32 Acacia Street, Golf Park, Meyerton 1961 (ZA). DAVIS, Bevan, John [ZA/ZA]; 5 Denham Road, Denham Green, Lakefield, Benoni 1501 (ZA). (74) Agent: GILL JENNINGS & EVERY; Broadgate House, 7 Eldon Street, London EC2M 7LH (GB).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.</p>

(54) Title: SILENCER



(57) Abstract

A silencer (10) includes a polymeric casing (12) spaced from at least one inlet pipe and at least one outlet pipe by polymeric spacers (52). The polymeric spacers are made from a different material to that of the polymeric casing. The polymeric spacers are heat-resistant and have a higher melting point than the polymeric casing. The polymeric spacers are made of a softer material than the polymeric casing, and the polymeric spacers are capable of being deformed to accommodate irregularities in the shape of the inlet and outlet pipes.

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SILENCER

BACKGROUND TO THE INVENTION

THIS invention relates to a silencer for a motor vehicle.

Free flow exhaust systems are widely used in the motor industry as they tend to improve the performance of a motor vehicle when compared to conventional exhaust systems. A drawback associated with free flow exhaust systems, however, is that the exhaust noise levels are considerably higher than for conventional exhaust systems, and are often higher than legal limits.

Attempts have been made to provide silencers or mufflers to reduce the noise of free flow exhaust systems to acceptable levels. Traditionally, this has entailed providing an elongate silencer which is positioned around a perforated section of the exhaust pipe to dampen the noise levels. As with conventional silencers, these free flow exhaust silencers are made from stainless steel or similar metallic materials. As a result, they generally have to be fitted by specialist fitters. They are also susceptible to corrosion and generally have to be replaced fairly often.

SUMMARY OF THE INVENTION

According to the invention a silencer includes a polymeric casing connected to at least one inlet pipe and to at least one outlet pipe by polymeric spacers.

The polymeric spacers are preferably heat-resistant, preferably have a higher melting point than the polymeric casing, are preferably made of a different material to that of the polymeric casing, are preferably flexible relative to the polymeric casing and are preferably softer than the polymeric casing.

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The polymeric spacers are capable of deformation to accommodate irregularities in the shape of the inlet and/or outlet pipes.

The inlet and outlet pipes are preferably made of metal which is preferably steel.

The casing preferably has collars, with the polymeric spacers being located between the collars and the inlet and outlet pipes. The housing preferably narrows towards the collars.

A sealant may be interposed between the polymeric spacers and their respective inlet and outlet pipes.

Preferably the polymeric spacers anchor the casing to the inlet and outlet pipes.

The polymeric spacers may be made from polytetrafluoroethylene.

The housing may include two sections secured to one another.

The two sections are preferably secured to one another by a connector. The two sections and the connector may have clip formations so that the two sections can be clipped to the connector. The connector may be a spacer to increase the length of the housing. Preferably the two sections are identical. Each section may include an integrally formed collar.

The polymeric casing is preferably made of a glass filled nylon.

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The inlet and outlet pipes preferably form part of a continuous pipe which extends through the housing, with at least part of the continuous pipe located within the housing being perforated. Insulating material preferably surrounds the continuous pipe. The insulating material may be a continuous length of glass wool wrapped around the continuous pipe.

The silencer may however have a plurality of inlet and outlet pipes. The inlet and outlet pipes may be formed by a plurality of continuous pipes extending through the housing, with at least part of each continuous pipe located within the housing being perforated.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The invention will now be described by way of non-limiting examples with reference to the accompanying drawings in which:

Figure 1 is an exploded, perspective view of a silencer according to the invention;

Figure 2 is a cross-sectional view on line 2 - 2 of the silencer of figure 1, fitted to a section of exhaust pipe; and

Figure 3 is a cross-sectional plan view of a silencer with twin exhaust pipes.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

A composite silencer 10 includes a nylon casing 12 of a three piece construction. The nylon casing 12 consists of two identical sections 14 and 16 connected together by a connector 18. The connector is positioned between openings 20 and 22 of the sections 14 and 16.

The two sections 14 and 16 and the connector 18 are clipped together via complementary clip formations 24 and 26. The clip formations 24 on the sections 14 and 16 are in the form of ring-like projections or lips surrounding openings 20 and 22. The clip formations 26 on the connector 18 are in the form of complementary receiving channels. Although this clip arrangement is preferred, it is envisaged that other appropriate arrangements such as male and female formations or bayonet-type formations could be used so that the two sections can be connected directly to one another.

Each of the sections 14 and 16 have integrally formed end walls 28 and 30, respectively, which narrow towards annular collars 32 and 34, respectively. The collars 32 and 34 have apertures 36 and 38 which are axially aligned and which allow an elongate exhaust pipe 40 to extend through the nylon casing 12. The exhaust pipe 40 has perforations 42 to allow exhaust gas passing through the exhaust pipe 40 to enter a chamber 44 defined by the casing 12.

Although this embodiment relates to a single, straight exhaust pipe 40, other exhaust pipe configurations can be used. As shown in figure 3, two exhaust pipes pass through the casing. In figure 3, the suffix .1 is used for parts corresponding to those figures 1 and 2. However the exhaust pipe configuration could consist of a single pipe entering the casing from one end, branching into two pipes via a Y-branch, the two branched pipes exiting the

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casing through the opposite end. Alternatively, this configuration can be reversed so that two exhaust pipes enter the casing with a single exhaust pipe exiting the casing. In each of these configurations, the respective casing sections 14 and 16 are adapted to accommodate the different configurations.

The sections 14 and 16 and the connector 18 are injection moulded from a glass filled nylon material known as nylon 66. This material consists of approximately 60 to 65% nylon and approximately 30 to 35% glass. Although it is envisaged that any other suitable heat resistant polymeric material may be used, nylon 66 is preferred because of its heat resistant properties. It can withstand working temperatures ranging from about -70° C up to about 200° C, and has a melting point of 261° C. It is also highly shock absorbent and is therefore able to withstand vibrations and other body fatigue during use. The polymeric material absorbs sound to a greater extent than stainless steel, because it is less dense.

Located between an outer surface 46 of the exhaust pipe 40 and inner walls 48 and 50 of the collars 32 and 34, respectively, are a pair of heat resistant spacers in the form of bushes 52. The bushes 52 are formed of a heat resistant polymeric material, in this case polytetrafluoroethylene (P.T.F.E.). The bushes 52 are pressed into position and form an interference fit between the inner walls 48 and 50 of the collars, and between the bores of the bushes 52 and the exhaust pipe 40. The bushes 52 substantially seal the ends of the chamber 44 and provide resistance to heat transfer from the exhaust pipe 40 to the casing 12 from hot exhaust gases passing through the exhaust pipe 40. Silicon sealant 54 is provided between the bushes and the exhaust pipe 40. This is necessary in certain situations as the bushes 52 and the casing 12 expand under heat. Since they have different heat expansion co-efficients, expansion of these components may result in gases leaking from the chamber 44, which is undesirable. The seals between the bushes and the collars and

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between the bushes and the exhaust pipe have withstood pressures of up to two bar above atmospheric pressure without leaking.

Although it is envisaged that other materials can be used for the bushes 52, P.T.F.E bushes are preferred because of their heat resistant properties. The P.T.F.E bushes 52 have a working temperature ranging from about -269° C to about 270° C, and have a melting point of about 380° C. The P.T.F.E. bushes can withstand heat spikes of up to 330°C, and is believed that they can withstand heat spikes up to as much as 370°C. This material therefore has the ability to withstand the high temperatures of the stainless steel exhaust and resist heat transfer to the casing 12. In addition, the bushes 52 are flexible and soft relative to the casing 12. The bushes 52 are therefore capable of deformation to conform to irregularities in the shape of the exhaust pipe 40 which may not be perfectly round.

A continuous length of glass wool 56 is wrapped around the exhaust pipe 40 within the chamber 44 to provide additional damping or muffling of the exhaust noise. The glass wool can withstand temperatures of up to 700°C.

Connectors 18 of variable widths can be used. As a result, the overall length of the casing 12 can be adjusted by using connectors 18 of different widths. This allows a user to change the length of the casing to suit a particular motor vehicle by simply changing a single part. The connectors 18 of different widths are colour coded to simplify the choice of connector 18.

The applicant envisages that the silencer 10 may be offered for sale in the form of a kit comprising the identical sections 14 and 16, at least one

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connector 18, the bushes 52, glass wool, and the stainless steel perforated exhaust pipe section 40. The kit can be readily assembled by winding the glass wool around the exhaust pipe 40, positioning the bushes 52 within the respective collars 32 and 34, sliding the two sections 14 and 16 over the pipe 40 with the connector 18 positioned between them, and clipping the pieces together. Typically, where additional sealing is required, the silicon sealant 54 will be put in place prior to clipping the pieces together. A section of an existing exhaust pipe is then replaced by the exhaust pipe 40 with the assembled silencer 10 fitted thereto. Alternatively, the silencer may be assembled *in situ* on an existing exhaust pipe that has been perforated.

The silencer according to the invention is believed to have a number of advantages over conventional stainless steel mufflers. Because the silencer of the invention is made from nylon, which is less dense than stainless steel, it tends to dampen or muffle sound to a greater extent than stainless steel. Further, the simple, yet effective, manner of clipping the various pieces together and frictionally fitting it to the free flow exhaust pipe will enable a user to fit the silencer a do-it-yourself (DIY) manner. No welding or special adhesives are required to assemble the silencer or fit it to the exhaust pipe. In addition, the user can vary the length of the silencer, to suit a particular make of vehicle, by interchanging connectors of different widths. Further, the silencer is smaller than conventional silencers because of the excellent noise dampening qualities of the nylon, and the silencer is between 35% and 55% lighter than equivalent steel exhausts.

It will be appreciated that many modifications or variations of the invention are possible without departing from the spirit or scope of the invention.

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CLAIMS

1. A silencer including a polymeric casing spaced from at least one inlet pipe and at least one outlet pipe by polymeric spacers.
2. The silencer of claim 1 wherein the polymeric spacers are heat-resistant.
3. The silencer of claim 1 or claim 2 wherein the polymeric spacers have a higher melting point than the polymeric casing.
4. The silencer of any of the above claims wherein the polymeric spacers are made of a different material to the polymeric casing.
5. The silencer of any of the above claims wherein the polymeric spacers are made of a softer material than the polymeric casing.
6. The silencer of any of the above claims wherein the polymeric spacers are capable of being deformed to accommodate irregularities in the shape of the inlet and/or outlet pipes.
7. The silencer of any of the above claims wherein the polymeric spacers are made of polytetrafluoroethylene.
8. The silencer of any of the above claims including a sealant interposed between the polymeric spacers and their respective inlet and outlet pipes.

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9. The silencer of any of the above claims wherein there is an interference fit between the polymeric spacers and their inlet and outlet pipes.
10. The silencer of any of the above claims wherein there is an interference fit between the polymeric spacers and the polymeric casing.
11. The silencer of any of the above claims including an insulating material within the housing.
12. The silencer of claim 11 wherein the insulating material is glass wool.
13. The silencer of any of the above claims wherein the housing includes two sections secured to one another.
14. The silencer of claim 13 wherein the two sections are secured to one another by a connector.
15. The silencer of claim 14 wherein the two sections and the connector have clip formations so that the two sections can be clipped to the connector.
16. The silencer of any of claims 13 to 15 wherein the two sections are identical.
17. The silencer of any of the above claims wherein the polymeric casing has collars with the polymeric spacers being located between the collars and the inlet and outlet pipes.

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18. The silencer of claim 17 wherein the polymeric casing narrows towards the collars.
19. The silencer of any of the above claims wherein the polymeric casing is made of a glass filled polymer.
20. The silencer of claim 19 wherein the glass filled polymer is a glass filled nylon.
21. The silencer of any of the above claims wherein the inlet and outlet pipes form part of a continuous pipe which extends through the casing, with at least part of the continuous pipe located within the casing being perforated.
22. The silencer of claim 21 wherein a continuous length of glass wool is wrapped around the continuous pipe.
23. The silencer of any of claims 1 to 20 including a plurality of inlet and outlet pipes.
24. The silencer of claim 23 wherein the inlet and outlet pipes are formed by a plurality of continuous pipes extending through the casing, with at least part of each continuous pipe located within the casing being perforated.
25. A silencer including a polymeric casing having collars with at least one inlet pipe and at least one outlet pipe, the inlet and outlet pipes being spaced from the collars by spacers located between the collars and the inlet and outlet pipes.

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26. A silencer including a polymeric casing with at least one inlet pipe to the polymeric casing with a polymeric spacer interposed between the polymeric casing and the inlet pipe, and at least one outlet pipe from the polymeric casing with a polymeric spacer interposed between the polymeric casing and the outlet pipe.
27. A silencer adapted to be fitted to at least one inlet pipe and at least one outlet pipe, the silencer including a polymeric casing and polymeric spacers for spacing the polymeric casing from the inlet and outlet pipes.
28. A kit for a silencer as claimed in any of the above claims, the kit including a polymeric sections for a polymeric casing.
29. A polymeric section for a polymeric casing of a silencer as claimed in any of claims 1 to 24, the polymeric section having a collar at one of its ends and an opening at the other of its ends, the section being adapted to be connected to another section to form the polymeric casing.
30. A connector for connecting two sections together to form a casing for a silencer as claimed in any of claims 1 to 24, the connector having formations onto which the two sections can be clipped.
31. A silencer substantially as herein described and illustrated with reference to the accompanying drawings.
32. A kit for a silencer, the kit being substantially as herein described and illustrated with reference to the accompanying drawings.

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33. A polymeric section for a casing of a silencer, the polymeric section being substantially as herein described and illustrated with reference to the accompanying drawings.
34. A connector for connecting two sections together to form a casing for a silencer, the connector being substantially as herein described and illustrated with reference to the accompanying drawings.

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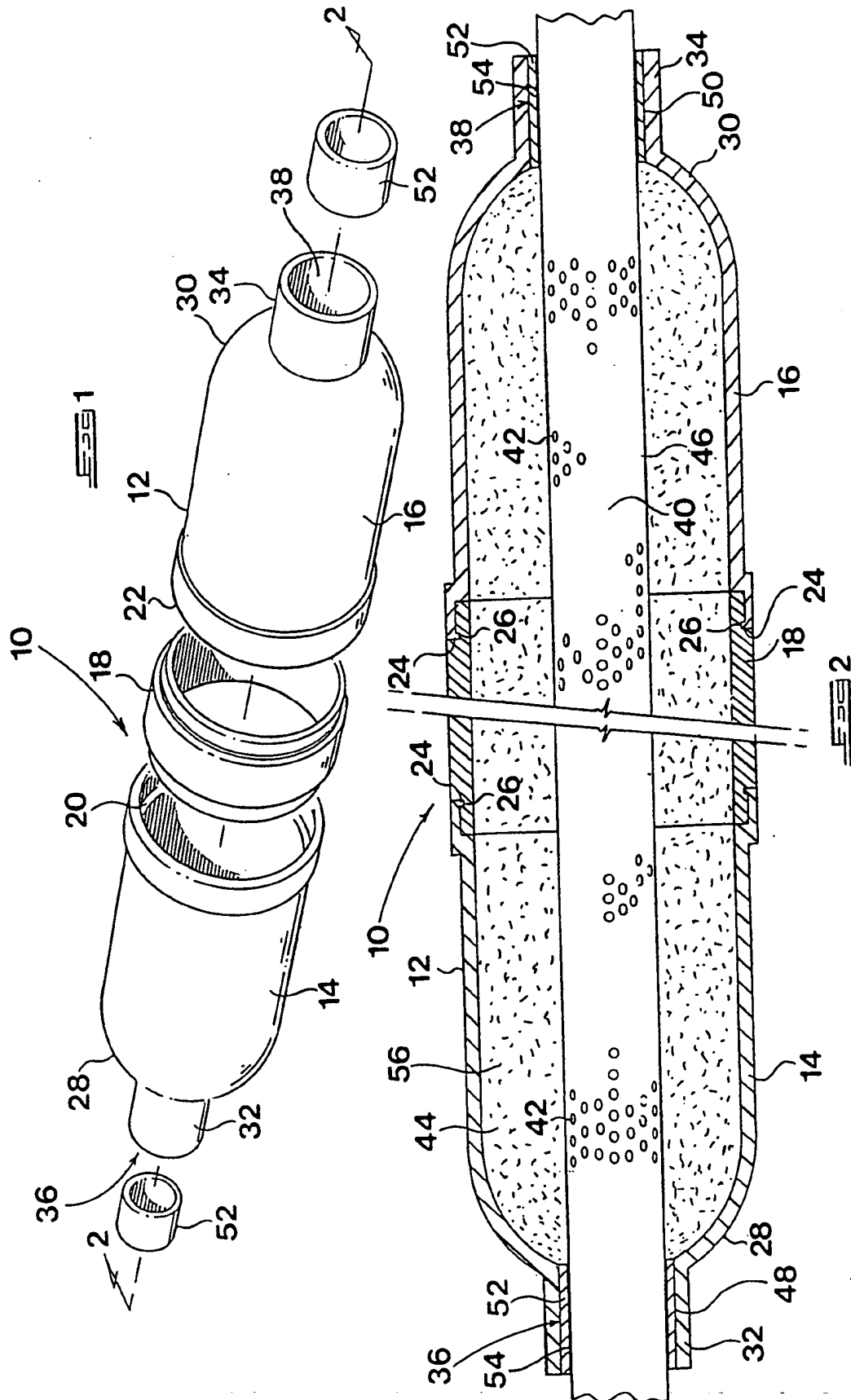
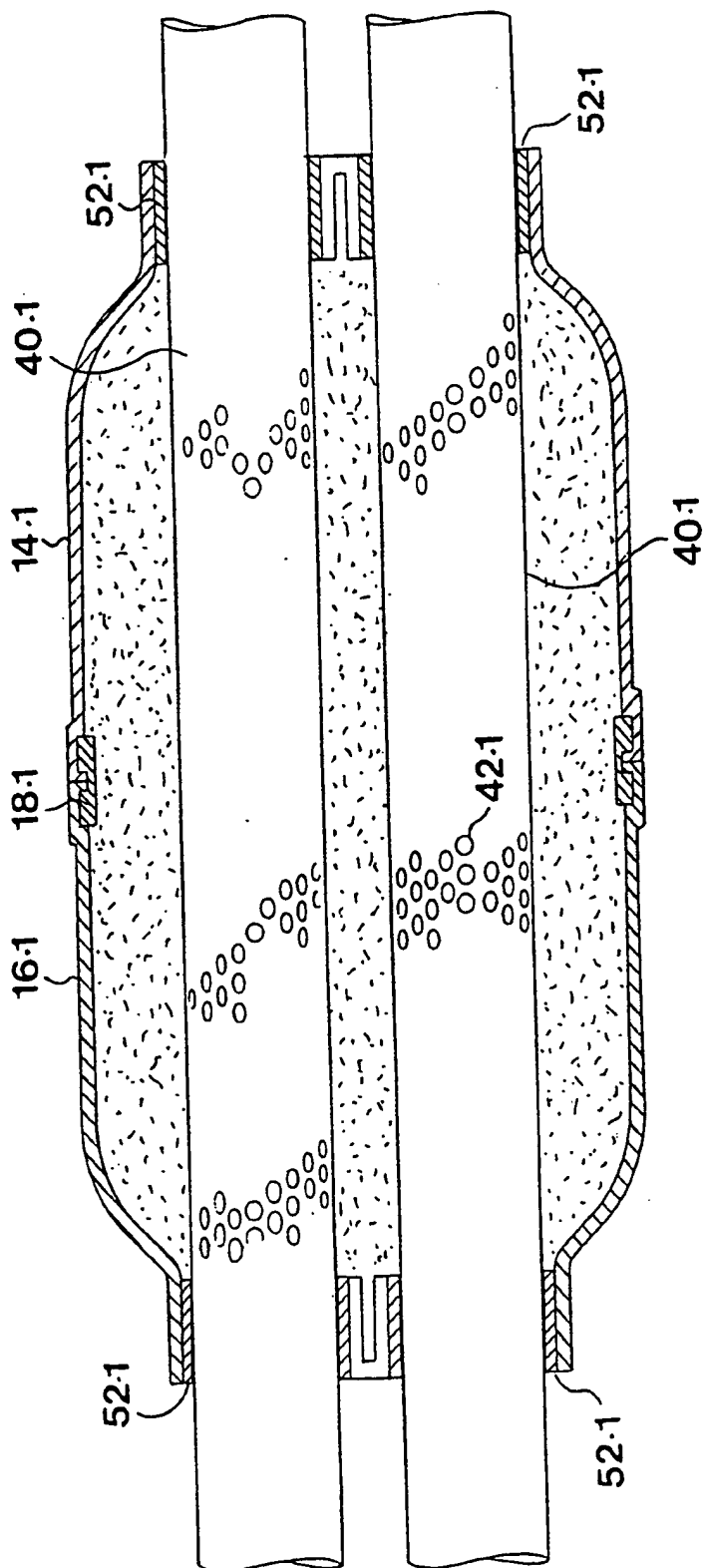


Fig. 3



INTERNATIONAL SEARCH REPORT

Int. Jonal Application No

PCT/GB 98/03490

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F01N1/24 F01N7/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 033 580 A (ACERBIS FRANCO) 23 July 1991	1-6, 9-14, 17, 18, 21, 22, 25-29, 31-34
Y	see column 2, line 30 - column 3, line 8; figures	19, 20
Y	EP 0 446 064 A (HONDA MOTOR CO LTD) 11 September 1991 see page 3, line 1 - line 18; figure 1	19, 20
X	US 4 239 091 A (NEGRAO PAULO M) 16 December 1980	25
A	see column 3, line 55 - column 4, line 25; figures	17, 18
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DE 43 26 304 C (DAIMLER BENZ AG) 1 December 1994 see column 1, line 44 - line 61; figure -----</p>	7

INTERNATIONAL SEARCH REPORT

...information on patent family members

Int: onal Application No

PCT/GB 98/03490

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5033580 A	23-07-1991	DE 68914139 D DE 68914139 T EP 0391014 A ES 2054093 T	28-04-1994 03-11-1994 10-10-1990 01-08-1994
EP 0446064 A	11-09-1991	JP 3257039 A CA 2037760 A,C DE 69105559 D DE 69105559 T	15-11-1991 09-09-1991 19-01-1995 13-04-1995
US 4239091 A	16-12-1980	BR 5701149 U	07-03-1978
DE 4326304 C	01-12-1994	NONE	